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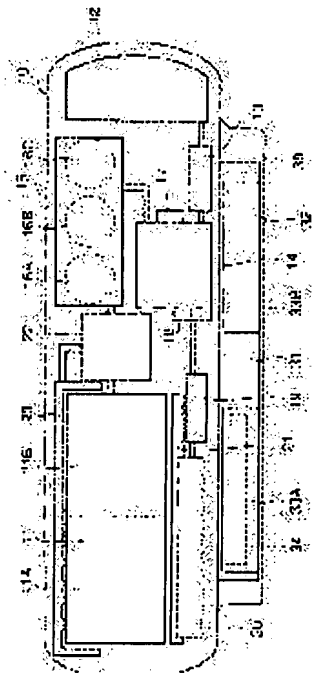
(54) DIRECT METHANOL FUEL CELL SYSTEM

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a direct methanol fuel cell system capable of supplying electric power to a load stably for a long period of time.

SOLUTION: The direct methanol fuel cell system comprises a stack cell 11 for generating an electromotive force through a chemical reaction of methanol solution supplied to an anode side and air supplied to a cathode side, a mixing tank 14 for mixing methanol and water to generate methanol solution, a first liquid feeding pump 13 for feeding the methanol inside a fuel cartridge 12 to the mixing tank 14, a heat exchanger 20 for heating and supplying the methanol solution from the mixing tank 14 to the anode and for cooling the methanol solution discharged from the anode, a second liquid feeding pump 19



deployed between the mixing tank 14 and the heat exchanger 20, an air feeding pump 22 for discharging air from the cathode, and a cooler 15 for cooling the air discharged from the air feeding pump 22 to supply water to the mixing tank 14.

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* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1]
In the direct mold methanol fuel cell system which uses a methanol as a fuel,
Electromotive equipment which carries out electromotive by the chemical reaction of the methanol water solution which has the anode and cathode which were formed in the both sides of an electrolyte membrane and this electrolyte membrane, respectively, and is supplied to an anode, and the air supplied to a cathode,
The fuel cartridge which held the methanol,
The mixing tank which mixes the methanol and water which are supplied from said fuel cartridge, and generates a methanol water solution,
The 1st liquid-sending pump which sends out the methanol in said fuel cartridge to said mixing tank,
The heat exchanger which cools the methanol water solution which heats the methanol water solution generated by said mixing tank, supplies said anode, and is discharged from said anode,
The 2nd liquid-sending pump which returns the methanol water solution which supplied the methanol water solution generated by said mixing tank to said heat exchanger, and was cooled by said heat exchanger to said mixing tank,
The supplied-air pump which carries out the regurgitation of the air which supplied the air adopted from the exterior to the 1st inhalation opening to said cathode from the 1st delivery, and was adopted from said cathode to the 2nd inhalation opening from the 2nd delivery,
The condensator which cools the air breathed out from said 2nd delivery, generates water, and supplies the this generated water to said mixing tank
The direct mold fuel cell system to provide.
[Claim 2]
Two electromotive units which have a methanol water-solution feed hopper with said common electromotive equipment, the methanol water-solution exhaust port according to individual, air supply opening according to individual, and a common air exhaust port, The unification member which the methanol water solution discharged from the methanol water-solution exhaust port according to said individual, respectively is made to join, and is supplied to said heat exchanger, The direct mold methanol fuel cell system according to claim 1 which has the tee material which the air breathed out from the 1st delivery of said supplied-air pump is dichotomized, and is supplied to air supply opening according to said individual, respectively.
[Claim 3]
The direct mold methanol fuel cell system according to claim 1 which possesses further a means to discharge the anode reaction product and air in said mixing tank outside.
[Claim 4]
The direct mold methanol fuel cell system according to claim 1 which possesses further the liquid level sensor and concentration sensor which detect the oil level and concentration of a methanol water solution in said mixing tank, respectively.
[Claim 5]
The direct mold methanol fuel cell system according to claim 1 which has the auxiliary power for starting further.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]
This invention relates to a fuel cell system, especially relates to a direct mold methanol fuel cell system suitable as a power source for actuation of electronic equipment etc.
[0002]
[Description of the Prior Art]
In recent years, expectation is growing to the fuel cell as the power source of portable electronic devices, such as various electronic equipment supporting an information society especially a note type personal computer, and a Personal Digital Assistant, or a power source for coping with air pollution and global warming.
[0003]
Since it has the property of the direct mold methanol fuel cell (DMFC) which generates electricity by taking out a direct proton from a methanol having an unnecessary refining machine, and there being little fuel volume, and ending also in a fuel cell, expectation of the application to the direction of many of a portable electronic device and others is growing.
[0004]
[Problem(s) to be Solved by the Invention]
Although it is necessary to control the concentration of the methanol water solution which is a fuel, a direct mold methanol fuel cell changes the optimal concentration with the magnitude of the load to change, and unless it carries out and sees, it is not understood how many supplies can do power to an external load with regards to the amount of supply of the methanol to supply in many cases. For this reason, the practical direct mold methanol fuel cell which can carry out electromotive to stability over a long period was unprecedented.
[0005]
This invention aims at offering the fuel cell system which can supply power to a load to stability over a long period of time.
[0006]
[Means for Solving the Problem]
In order to solve the above-mentioned technical problem, the direct mold methanol fuel cell system concerning this invention The electromotive equipment which carries out electromotive by the chemical reaction of the methanol water solution which has the anode and cathode which were formed in the both sides of an electrolyte membrane and this electrolyte membrane, respectively, and is supplied to an anode, and the air supplied to a cathode, The mixing tank which mixes the fuel cartridge which held the methanol, and the methanol and water which are supplied from a fuel cartridge, and generates a methanol water solution, The 1st liquid-sending pump which sends out the methanol in a fuel cartridge to a mixing tank, The heat exchanger which cools the methanol water solution which heats the methanol water solution generated by the mixing tank, supplies anode passage, and is discharged from anode passage, The 2nd liquid-sending pump which returns the methanol water solution which supplied the methanol water solution generated by the mixing tank to the heat exchanger, and was cooled by the heat exchanger to a mixing tank, The supplied-air pump which carries out the regurgitation of the air which supplied the air adopted from the exterior to the 1st inhalation opening to cathode passage from the 1st delivery, and was adopted from cathode passage to the 2nd inhalation opening from the 2nd delivery, The air breathed out from the 2nd delivery is cooled and it has the condensator which supplies the water which

generated and this generated water to a mixing tank.

[0007]

[Embodiment of the Invention]

Hereafter, the gestalt of operation of this invention is explained with reference to a drawing.

The rough configuration of the direct mold methanol fuel cell (DMFC) system applied to 1 operation gestalt of this invention at drawing 1 is shown. On the left-hand side of [in drawing] the casing 10 interior made by box-like [flat], the stack cel 11 which is DMFC electromotive equipment is arranged along with the longitudinal direction of casing 10. The stack cel 11 consists of two cel units 11A and 11B in this example. About the detailed configuration of a stack cel unit, it mentions later.

[0008]

The fuel cartridge 12 is arranged at the edge by the side of drawing Nakamigi of the casing 10 interior. The fuel cartridge 12 holds the methanol which is a fuel in a suitable container. An end is made to counter a fuel tank 12, the 1st liquid-sending pump 13 which is a fuel pump is arranged, the other end of this 1st liquid-sending pump 13 is countered, and the mixing tank 14 is arranged. In this example, the condensator 15 which has three fans 16A, 16B, and 16C is arranged at the drawing Nakagami side of a mixing tank 14.

[0009]

A mixing tank 14 mixes the methanol sent with the 1st liquid-sending pump 13 from the fuel cartridge 11, and the water sent from a condensator 15, and generates a methanol water solution. The concentration sensor 17 which detects the concentration of the methanol water solution in a mixing tank 14, and the liquid level sensor 18 which detects the oil-level location of a methanol water solution are attached in the mixing tank 14.

[0010]

An end is made to counter the 1st liquid-sending pump 13 and opposite hand of a mixing tank 14, and the 2nd liquid-sending pump 19 is formed. The drawing Nakashita side of the other end of the 2nd liquid-sending pump 19 and the stack cel 11 is adjoined, and the heat exchanger 20 is formed. A heat exchanger 20 cools heating of the methanol water solution supplied to the stack cel 11, and the methanol water solution outputted from the stack cel 11. Between the stack cel 11 and the heat exchanger 20, the anode output unification member 21 which the methanol water solution outputted from each anode passage of the cel units 11A and 11B is made to join, and is led to a heat exchanger 19 is formed.

[0011]

The supplied-air pump 22 is formed between the stack cel 11 and the condensator 15. The air which the supplied-air pump 22 adopts air from the exterior, and sends it into the stack cel 11, and is discharged from the stack cel 11 is sent out to a condensator 15. Between the stack cel 11 and the supplied-air pump 22, the air tee material 23 for dichotomizing the air breathed out from the supplied-air pump 22, and supplying each cathode passage of the stack cel units 11A and 11B is formed.

[0012]

The subcasing 30 is formed in the drawing Nakashita side of casing 10 in one with casing 10. The substrate 31 is formed in the subcasing 30. On one field of a substrate 31, the auxiliary power 32 for starting used at the time of starting of a DMFC system is formed. The auxiliary power 32 for starting consists of two rechargeable lithium-ion batteries 33A and 33B in this example. The integrated-circuit-ized control circuit 34 is mounted in the field of another side of a substrate 31. A control circuit 34 is explained in detail later. The load which receives supply of power from a DMFC system, for example, a personal computer, (PC) was equipped with the subcasing 30, and it serves as the interface with PC.

[0013]

Next, the detailed example of a configuration of the stack cel 11 is explained using drawing 2 .

The stack cel 11 consists of the anode and cathode which have been arranged at an electrolyte membrane 40 and its both sides. In an anode, a cathode contains the cathode charge collector 43 and the cathode catalyst bed 44 including the anode charge collector 41 and the anode catalyst bed 42. The Nafion film which has for example, high proton conductivity is used for an electrolyte membrane 40. PtRu with little poisoning as a catalyst is used for the anode catalyst bed 42, and Pt is used for the cathode catalyst bed 44 as a catalyst.

[0014]

The anode passage plate 45 arranged on the outside of the anode charge collector 41 has the anode passage for pouring a methanol water solution. The methanol water-solution feed hopper 46 prepared in anode passage

common to the stack cel units 11A and 11B and the methanol water-solution exhaust ports 47A and 47B prepared according to the individual at every cel unit 11A and 11B are formed. The heat exchanger 20 shown by drawing 1 is connected to the methanol water-solution feed hopper 46. The anode output unification member 21 shown by drawing 1 is connected to the methanol water-solution exhaust ports 47A and 47B.

[0015]

On the other hand, the cathode passage plate 48 arranged on the outside of the cathode charge collector 43 has the air passage for passing the air which is an oxidizer. The air supply openings 49A and 49B prepared according to the individual in every cel unit 11A and 11B and the air exhaust port 50 prepared common to the stack cel units 11A and 11B are formed in air passage. Two air regurgitation edges of the air tee material 23 shown in the air supply openings 49A and 49B by drawing 1 are connected, respectively. Inhalation opening of the supplied-air pump 22 shown by drawing 1 is connected to the air exhaust port 50.

[0016]

In the stack cel 11 of this structure, a generation of electrical energy is performed by supplying a methanol water solution to the anode catalyst bed 42 by a proton's (proton's) occurring by catalytic reaction, and the generated proton passing through an electrolyte membrane 40, and reacting on the oxygen supplied to the cathode catalyst bed 44, and a catalyst.

[0017]

That is, when the methanol water solution supplied to the anode passage in the anode passage plate 45 from the methanol water-solution feed hopper 46 sinks in in the anode charge collector 41 in contact with an anode charge collector 41 like anode carbon paper, a methanol water solution is supplied to the anode catalyst bed 42. On the other hand, when the air adopted from the air supply openings 49A and 49B by the cathode passage in the cathode passage plate 48 sinks into the cathode charge collector 43, air is supplied to the cathode catalyst bed 44. Thus, electromotive is performed by the chemical reaction by supplying a methanol water solution to the anode catalyst bed 42, and supplying air to the cathode catalyst bed 44.

[0018]

The methanol water solution which remained without not all sinking into the anode charge collector 42, and the methanol water solution supplied to the anode passage in the anode passage plate 45 from the methanol water-solution feed hopper 46 sinking into the anode charge collector 42 is discharged from the methanol water-solution exhaust ports 47A and 47B. Similarly, the air which remained without not all sinking into the cathode charge collector 43, and the air adopted from the air supply openings 49A and 49B by the cathode passage in the cathode passage plate 48 sinking into the cathode charge collector 43 is discharged from the air exhaust port 50.

[0019]

Next, it explains that the methanol in the DMFC system of this operation gestalt, a methanol water solution, air, water, and emission gas flow using drawing 3 . Drawing 3 distinguishes and shows the flow of a methanol, a methanol water solution, air, water, and emission gas according to the pattern of an arrow head.

[0020]

First, it describes that the methanol in the anode system of the stack cel 11 thru/or a methanol water solution flow. a methanol thru/or a methanol water solution -- fuel cartridge 12 -> 1st liquid-sending pump 13 -> mixing-tank 14-> -- the 2nd -- a liquid-sending pump 19 -> heat exchanger 20 -> stack cel 11 -> anode output -- it flows in the path of the unification member 21 -> heat exchanger 20 -> 2nd liquid-sending pump 19 -> mixing tank 14.

[0021]

That is, a methanol water solution is generated by being mixed with the water which the methanol in the fuel cartridge 12 is sent to a mixing tank 14 with the 1st liquid-sending pump 13, and is sent from a condensator 15 here. After the methanol water solution generated with the mixing tank 14 is sent to a heat exchanger 20 and heated with the 2nd liquid-sending pump 19 here, it is supplied to the anode passage in the anode passage plate 45 from the methanol water-solution feed hopper 46 shown in drawing 2 of the stack cel 11, and it is supplied to the anode catalyst bed 42 through the anode charge collector 41.

[0022]

After the methanol water solution which remained without sinking into the anode charge collector 42 among the methanol water solutions supplied to the anode passage in the anode passage plate 45 is discharged from the

methanol water-solution exhaust ports 47A and 47B and joins by the anode output unification member 21, it is sent to a heat exchanger 20, after being cooled here, is sent to a mixing tank 14 and recovered by the 2nd liquid-sending pump 19.

[0023]

Next, it describes that the air in the cathode system of the stack cel 11 flows.

air -- open air -> supplied-air pump 22 -> air tee material 23-> -- the 2nd -- a liquid-sending pump 19 -> heat exchanger 20 -> stack cel 11 -> anode output -- it flows in the path of the unification member 21 -> heat exchanger 20 -> 2nd liquid-sending pump 19 -> mixing tank 14.

[0024]

That is, with the supplied-air pump 22, the air incorporated from the outside is supplied to the cathode passage in the cathode passage plate 48 from the air supply openings 49A and 49B shown in drawing 2 of the stack cel 11 through the air tee material 23, and is supplied to the cathode catalyst bed 44 through the cathode charge collector 43.

[0025]

The air which remained without sinking into the cathode charge collector 43 among the air supplied to the cathode passage in the cathode passage plate 48 is discharged from the air exhaust port 50. The discharged air is sent to a condensator 15 with the supplied-air pump 22, and water is generated by being cooled here. A methanol water solution is generated by being mixed with the methanol which the generated water is supplied to a mixing tank 14, and is supplied through the 1st liquid-sending pump 13 here from the fuel cartridge 12. On the other hand, the anode reaction product and air in a mixing tank 15 are discharged outside.

[0026]

The example of the concrete circuit diagram of a control circuit 34 is shown in drawing 4 . The electromotive output of the electrical-potential-difference value of 8.4-14.4V which are generated from the stack cel 11 is inputted into a terminal CN1, and a load, for example, PC, is supplied through switches S51-S54, resistance R27, diode D 1-1, and resistance R28. Resistance R27 and R28 is the objects for current detection, and the ends electrical potential difference is outputted as current detecting signals I1 and I3 through amplifier B7 and B8.

[0027]

On the other hand, the AC adapter auxiliary power which is the external auxiliary power which has an electrical-potential-difference value beyond 15V is connected to a terminal CN5. The output of AC adapter auxiliary power is supplied to a battery charger 51 through a switch S8 and diode D3. The electromotive output from the stack cel 11 is also supplied to a battery charger 51 through diode D2. The rechargeable lithium-ion battery (LIB) which is the auxiliary power 32 for starting is connected to a battery charger 51 through switches S7 and S6 and resistance R29. Resistance R29 is an object for current detection, and the ends electrical potential difference is outputted as a current detecting signal I2 through amplifier B9. To PC which is a load, it is also possible to supply the output of LIB through diode D 1-2.

[0028]

A measuring circuit 53 inputs the temperature signal T1 which shows the temperature of each part of the voltage signals V1-V4 of each part in drawing 4 , current signals I1-I4, and the stack cel 11 - T four, changes these values into digital one, and sends them to CPU54.

[0029]

CPU54 performs control of various kinds of switches S1, S2, S3, S51-S54 shown in drawing 4 , S6 and S7, a battery charger 51, DC-DC converter 52, a measuring circuit 53, and the UART driver 57, and also controls EEPROMs 55 and 56 which are rewritable nonvolatile memory electrically. CPU54 operates considering the electromotive output from the stack cel 11 supplied through diode D7, the AC adapter auxiliary power output supplied through diode D8, or the rechargeable lithium-ion battery output supplied through diode D6 as a power source.

[0030]

DC-DC converter 52 is a driver which drives the fan of the 1st liquid-sending pump 13 mentioned above, the 2nd liquid-sending pump 19, the supplied-air pump 22, and a condensator 15, carries out DC-DC conversion of the rechargeable lithium-ion battery output supplied through the electromotive output or the switch S2, and diode D4 from the stack cel 11 which are supplied through a switch S3 and diode D5, and generates a driving signal.

[0031]
The item about the fuel cartridges 12, such as ID, concentration of the built-in methanol, capacity of a container, and magnitude of a gate, is memorized by EEPROM55 added to the fuel cartridge 12. On the other hand, various information, such as an amount of the methanol water solution supplied with the 2nd liquid-sending pump 19, an amount of the air supplied with the supplied-air pump 22, and temperature, is memorized by another EEPROM56. The information memorized by these EEPROMs 55 and 56 is transmitted to an external host computer for example, through I2 C bus.
[0032]
The mode transition diagram of the DMFC system of this operation gestalt is shown in drawing 5 . As shown in drawing 5 , there are the six modes, a 1.0:sleep mode, a 2.0:sleep mode, 3.0:system-supply mode, 4.0:termination mode, 5.0:external auxiliary power mode, and a 6.0:manual mode. Hereafter, the shift conditions between the main modes are explained.
[0033]
[1.0: Sleep mode]
A sleep mode means the condition that the DMFC system is not operating. A power source is supplied by LIB, and CPU54 is in the condition of the low consumed electric current by low-speed clock (32kHz) actuation, and maintains initial setting of a microcomputer input/output terminal.
[0034]
At the time of the following interruption reception, a high-speed clock is put into operation, and it operates with a high-speed clock until each cause of interruption is completed.
**1 RESET; initialization of a microcomputer port.
**2 Power switch S1 ON; it shifts to starting mode.
**2 EEPROM access from the outside; processing changes with contents of EEPROMs 55 and 56.
**3 When external auxiliary power (AC adapter auxiliary power) was connected and an electrical potential difference is inputted; boosting-charge control / UART communication link.
**4 a fuel cartridge -- attachment-and-detachment; -- the renewal of fuel cartridge information.
[0035]
[1.1: Shift condition] from a sleep mode to starting mode
External access has the power switch S1 to ON and EEPROM at the time of 18h!= "0" of EEPROM, and if a high-speed clock is put into operation and all the following starting mode shift conditions are satisfied when it is 18h= of 100ms after [EEPROM]."0", it will shift to starting mode.
[0036]
Starting mode shift condition =
and Fuel cartridge connection
and (residue > fuel tank low warning residue in a fuel cartridge (40h))
and (LIB electrical-potential-difference >DMFC system startup initiation, LIB electrical potential difference (68h))
and (more than the electrical potential difference (6Eh) judged to be dip sensor input voltage > dip)
and Inside of a DMFC system initiation temperature requirement (60h-62h).
[0037]
[2.0:starting mode]
On conditions from which the generation-of-electrical-energy capacity of a DMFC system will be in a steady state early, actuation control of each auxiliary machinery is carried out. At the time of a start, an accessory vessel is driven from LIB. First, when it goes into starting mode by interruption of the power switch S1, the value of 18h of the RAM sections of Built-in EEPROM is set to "0" like the case where access from PC system to EEPROM is carried out. It starts by [of each accessory vessel] carrying out an actuation start.
CPU54 operates with a high-speed clock, scans each input in a system, and updates information. The acquired information communicates by UART. If the current supplied to each auxiliary machinery is set to 0mA from LIB, processing will move from starting mode to system-supply mode shift.
[0038]
(External interruption)
**1 Initialization of a RESET; microcomputer port -> to a sleep mode

**2 Power switch; to termination mode
**2 EEPROM access from the outside; processing changes with contents of the EEPROM.
**3 When external auxiliary power was connected and an electrical potential difference is inputted; boosting-charge control.
**4 a fuel cartridge -- attachment-and-detachment; -- updating and error processing of fuel cartridge information.
[0039]
[The shift conditions from 2.1:starting mode to system-supply mode]
By the ability checking that a DMFC system is the stationary output state which can drive a load enough, it shifts to system-supply mode. If the following shift conditions continue for 2 seconds and are satisfied, for example at the time of the starting control mode, it will shift to system-supply mode.
[0040]
System-supply mode shift condition =
(LIB_I == 0mA) (or (current output current >=DMFC peak-output-current +LIB discharge current))
and (from LIB_V(rechargeable battery monitor) > starting to a supply mode transition LIB electrical potential difference (6Ah))
and (from DMFC temperature >= starting to supply mode transition DMFC temperature (6Ch))
and (DMFC temperature <DMFC continuation maximum temperature (63h)) .
[0041]
[The shift conditions from 2.2:starting mode to termination mode]
**1 Power-off of PC; when 18h of the RAM sections is able to be started in the power-source State other than "0" and "2" after [of the external interruption to EEPROM] 100ms, it shifts to termination mode.
**2 Power-off of DMFC of DMFC; when a power switch is pushed less than 2 seconds, it shifts to the usual termination mode. Although the termination control procedure in termination mode is performed one by one when a power switch is pushed 2 seconds or more, the measurement cycle, its renewal actuation of information, and UART communication link actuation in every 100ms are continued. The shift to a sleep mode is not carried out.
[0042]
[3.0:system-supply mode]
Usually, all the load actuation and auxiliary machinery actuation are provided with a DMF output, and long duration stability operation control is continued. To the power demand exceeding the instantaneous power demand of a load, or DMFC generation-of-electrical-energy capacity, LIB fills up an insufficiency. When there is DMFC generation-of-electrical-energy capacity beyond the supply voltage to a load, float charge of the dump power is carried out to LIB.
[0043]
(External interruption)
**1 Initialization of a RESET; microcomputer port -> it shifts to a sleep mode.
**2 Power-on switch; it shifts to termination mode.
**2 EEPROM access from the outside; processing changes with contents of the EEPROM.
**3 When external auxiliary power was connected and an electrical potential difference is inputted; boosting-charge control is performed.
**4 When a fuel cartridge is detached and attached; updating and error processing of fuel cartridge information are performed.
[0044]
[The shift conditions from 3.1:system-supply mode to termination mode]
**1 Power-off of PC; when the power-source State other than "0" and "2" is written to 18h of the RAM sections after [of the external interruption to EEPROM] 100ms, it shifts to termination mode.
**2 Power-off of DMFC of DMFC; when a power switch is pushed less than 2 seconds, it shifts to the usual termination mode. Although the termination control procedure in termination mode is performed one by one when a power switch is pushed 2 seconds or more, the measurement cycle, its renewal actuation of information, and UART communication link actuation in every 100ms are continued. The shift to a sleep mode is not carried out.

[0045]
[4.0:termination mode]
Control which maintains the condition of each auxiliary machinery is carried out so that long duration preservation may be possible, and it shifts to a sleep mode. The full charge of the LIB is carried out. Methanol concentration is reduced to a DMFC anode, and desiccation control of a supplied-air pump is carried out, and it ends. When the time amount which the off-data from PC were written to EEPROM, or is pushing the power switch S1 is less than 2 seconds, processing with the usual termination mode is carried out.
[0046]
When the power switch S1 is pushed 2 seconds or more, it shifts to termination mode, but CPU54 continues renewal of an input scan and information, and continues a UART communication link until the power switch of DMFC is pushed again. When the power switch of DMFC is again pushed during processing with the usual termination mode, it shifts to starting mode.
[0047]
(External interruption)
**1 Initialization of a RESET; microcomputer port -> to a sleep mode
**2 Power switch-on; it changes with the time amount and the situations which were pushed.
**2 EEPROM access from the outside; processing changes with contents of the EEPROM.
**3 When external auxiliary power was connected and an electrical potential difference is inputted; boosting-charge control.
**4 a fuel cartridge -- attachment-and-detachment; -- updating and error processing of fuel cartridge information.
[0048]
(4.0: Termination mode)
**1 Charge OFF after a LIB full charge.
**2 The 1st liquid-sending pump 13 and the 2nd liquid-sending pump 19 are suspended.
**3 The supplied-air pump 22 is suspended after time amount progress of description at the RAM section 6Dh address of EEPROM from a halt of the 2nd liquid-sending pump 19.
**4 A lid is closed.
**5 If the cooling fan is operating, it will wait until it can cool to the temperature to stop.
**6 Off in a switch 3 (DMFC_ASS) and a switch 2 (LIB_ASS).
The power switch of DMFC stands by in this condition, when it is pushed 2 seconds or more and shifts to termination mode.
The next processing is performed at the time of the power switch of DMFC being pushed again, and the time of the usual termination control mode.
**7 Measurement-cycle OFF and measuring circuit power-source OFF.
**8 UART communication link OFF.
**9 High-speed clock-off; the level of each output port is set as initial value, and it shifts to a sleep mode.
[0049]
[The shift conditions from 4.1:termination mode to a sleep mode]
When a termination modal-control procedure finishes.
[0050]
[The shift conditions from 4.2:termination mode to starting mode]
External access has the power switch S1 to ON or EEPROM at the time of 18h!= "0" of EEPROM, and if a high-speed clock is put into operation and all the following starting mode shift conditions are satisfied when it is 18h= of 100ms after [EEPROM] "0", it will shift to the starting control mode.
[0051]
Starting mode shift condition =
and Fuel cartridge connection
and (residue > fuel tank low warning residue in a fuel cartridge (40h))
and (rechargeable battery electrical-potential-difference >DMFC starting initiation LIB electrical potential difference (68h))
and (more than the electrical potential difference (6Eh) judged to be dip sensor input voltage > dip)

and Inside of a DMFC initiation temperature requirement (60h-62h).

[0052]

[Effect of the Invention]

As stated above, according to this invention, stability can be provided with the direct mold methanol fuel cell system which can supply power to a load over a long period of time.

[Brief Description of the Drawings]

[Drawing 1] The top view showing the outline configuration of the direct mold methanol fuel cell system concerning 1 operation gestalt of this invention

[Drawing 2] Drawing showing the example of a configuration of the stack cel (electromotive equipment) in this operation gestalt

[Drawing 3] Drawing showing the flow of the methanol in this operation gestalt, a methanol water solution, air, water, and emission gas

[Drawing 4] Drawing showing the example of the concrete circuit diagram of the control circuit in this operation gestalt

[Drawing 5] Drawing showing the mode transition in this operation gestalt

[Description of Notations]

10 -- Casing
11 -- Stack cel (DMFC electromotive equipment)
12 -- Fuel cartridge
13 -- The 1st liquid-sending pump (fuel feed pump)
14 -- Mixing tank
15 -- Condensator
16A-16C -- Fan
17 -- Concentration sensor
18 -- Liquid level sensor
19 -- The 2nd liquid-sending pump
20 -- Heat exchanger
21 -- Anode output unification member
22 -- Supplied-air pump
23 -- Air tee material
30 -- Subcasing
31 -- Substrate
32 -- Auxiliary power for starting
33A, 33B -- Rechargeable lithium-ion battery
34 -- Control circuit

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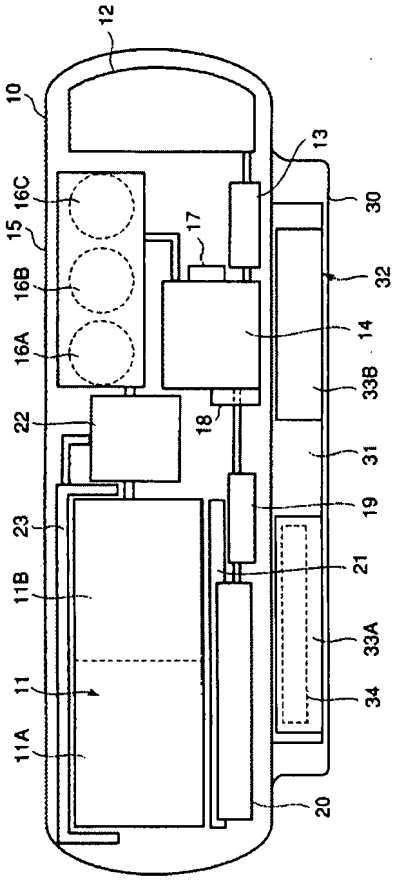
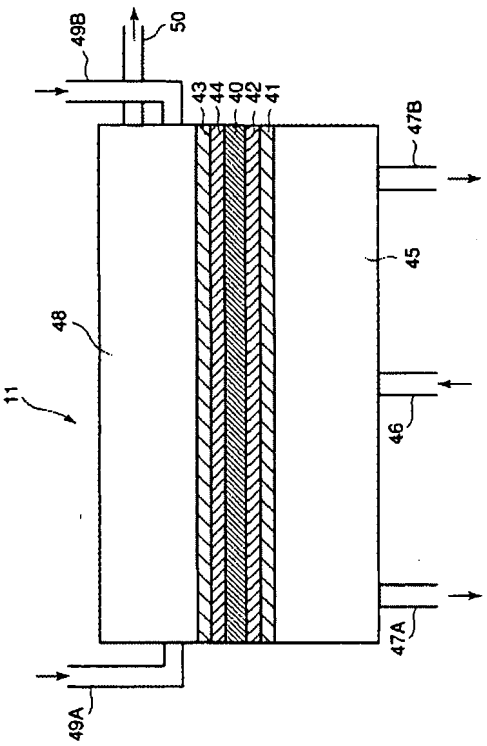
DRAWINGS

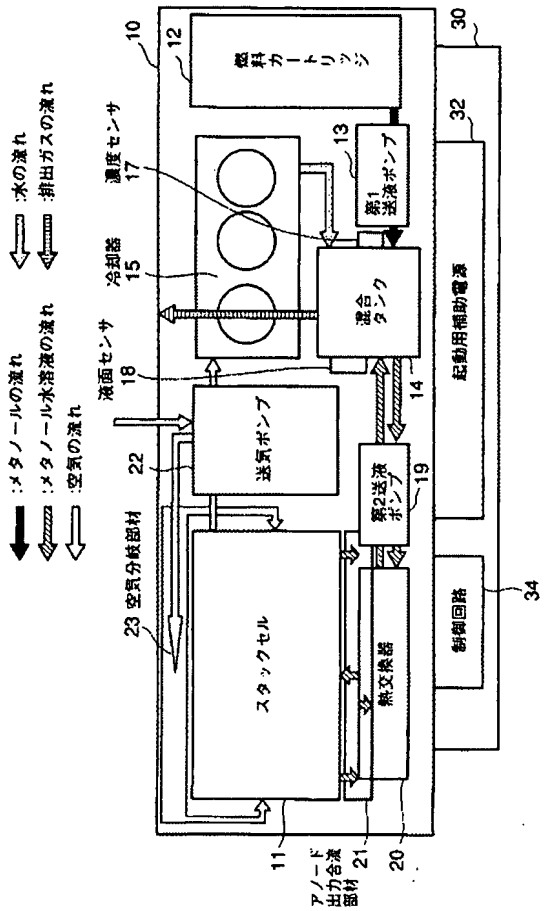
[Drawing 1]



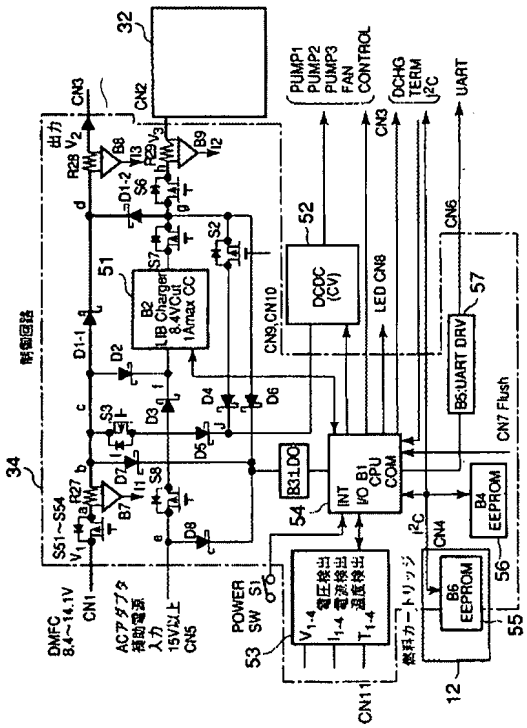
[Drawing 2]



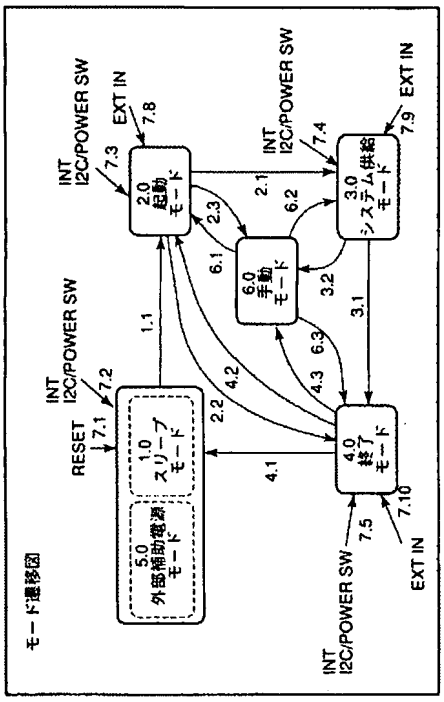
[Drawing 3]


:メタノールの流れ
:メタノール水溶液の流れ
:空気の流れ
:水の流れ
:排出ガスの流れ
10
12
燃料カートリッジ
30
32
濃度センサ
17
13
第1送液ポンプ
冷却器
15
混合タンク
液面センサ
18
14
起動用補助電源
送気ポンプ
22
第2送液ポンプ
19
空気分岐部材
23
スタックセル
熱交換器
制御回路
34
11
アノード出力合流部材
21
20

[Drawing 4]


32
CN3
CN2
PUMP1
PUMP2
PUMP3
FAN
CONTROL
DCHG
TERM
I2C
UART
CN3
CN6
52
DCDC
(CV)
CN9,CN10
LED CN8
57
B5:UART DRV
CN7 Flush
51
B2
LIB Charger
8.4V/Out
1Amax CC
D1-1
D2
D3
D4
D6
D5
S3
S4
S7
S2
S8
D7
D8
34
S51~S54
R27
B7
R28
B8
B9
R29
D1-2
S6
B31:LDO
54
INT
I/O B1
CPU
COM
I2C
CN4
B4
EEPROM
56
B6
EEPROM
55
12
CN11
53
POWER
SW S1
DMFC
8.4~14.1V
CN1
AC7ダクタ
補助電源
入力
15V以上
CN5
燃料カートリッジ

[Drawing 5]



[Translation done.]